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REPORT

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SUBJECT Soviet Article on Problems in Atmospheric Physics

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abstracts from the K Ya Kondrati'ev, Professor at the University of Leningrad, publication entitled "Problems in Atmospheric Physics". The abstracts concern the subjects: "On the Possibility of Direct Measurement of Radiative Heat Influx"; "Experimental Investigation of Radiation Balance in the Free Atmosphere"; "Investigation of Applicability of the Law of Normal Distribution of Random Values for Obtaining Characteristics of Wind Regime in the Free Atmosphere"; "On the Function of Infrared Radiation Absorption in the Mesosphere and Upper Stratosphere".

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PROBLEMS IN ATMOSPHERIC PHYSICS

COLLECTED WORKS 1.

CONTENTSPage

1. KONDRAT'EV, K. Ya.: ON THE POSSIBILITY OF DIRECT MEASUREMENT OF RADIATIVE HEAT INFLUX.

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This article discusses controversial results of heat influx measurements by the method of "black ball". The experimental results show that there are similarities in profiles obtained by heat balance meters and by the "black ball" method; yet in some cases, particularly for the lower part of the troposphere (below 500-mb level) the "black ball" measurements show the heat influx of opposite sign for some layers of the atmosphere, thus showing that the difference in measurement is not only in quantity but in quality as well. This situation is explained by two factors: 1) theoretical qualitative computations are valid only for particular individual cases and have therefore no general significance, and 2) the accuracy of measurements in all cases is very small. The author concludes that the "black ball" method should be considered only as an empirical one and valid only for certain atmospheric situations. Thus the problem is in determination of qualitative limits when the "black ball" method is applicable. The same considerations are applicable to the radiation instruments built on the "black ball" principle.

2. KONDRAT'EV, K. Ya.; GAEVSKAYA, G. N.; NIKOL'SKII, G. A.: EXPERIMENTAL INVESTIGATION OF RADIATION BALANCE IN THE FREE ATMOSPHERE.

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The article reviews the experimental investigations of radiation fluxes in the free atmosphere as observed from aeroplanes and captive balloons; summarizes the results; considers the methods and the accuracy of measurements; and outlines the ^{prospects} perspectives of further development of work in this sphere. The authors conclude that these are only the first steps made towards the solution of the problem of experimental investigations of the vertical profile of radiation balance and its components in the system "earth's surface - atmosphere", the macroalbedo of the underlying surface, etc. The basic problems requiring solution in the nearest future can be formulated as such:

- 1) Close investigation of the standard actinometric instrumentation with the purpose of its applicability to the measurement of radiation balance and its components in the free atmosphere.
- 2) Further development, improvement and wide use of actinometric radiosondes.
- 3) Construction of special complex instruments for reliable measurement of radiation balance and its components as well as quantitative determination of characteristics of factors affecting the transformation of radiation field (humidity, aerosols in the atmosphere, ozone, etc.)
- 4) Development of methods for direct measurement of radiation heat influx.
- 5) Study of the basic factors regulating the transformation of shortwave radiation fluxes and heat radiation in the atmosphere.
- 6) Study of the characteristic properties of vertical profile and geographic distribution of radiation balance in connection with the principal rules of weather-forming processes.
- 7) Determination of the function of radiative heat flux as a factor in thermal regime and dynamics of troposphere and stratosphere.

Good international bibliography at the end of the article covers recent literature on the subject.

3. SOLONIN, S. V.; LIBERMAN, Yu. M.: INVESTIGATION OF APPLICABILITY OF THE LAW OF NORMAL DISTRIBUTION OF RANDOM VALUES FOR OBTAINING CHARACTERISTICS OF WIND REGIME IN THE FREE ATMOSPHERE

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The authors discuss the application of statistical law of normal distribution of random values to obtain characteristics of wind regime in the free atmosphere. The statistical methods are widely used in problems on time and space variations of meteorological elements, on atmospheric turbulence, in the construction of various functions, etc. Development of these methods show promising perspectives for weather forecasting. Insufficient investigation of thermal and dynamic processes at high altitude, limited data and their comparatively low quality, makes the statistical approach to the investigation of regulations in general circulation (wind regime) in the upper troposphere and stratosphere especially efficient. In this article the results of pilot balloon data and its analysis for Moscow and Sverdlovsk regions are treated for the purpose of finding out whether the law of normal distribution of random values could be used to obtain climatological characteristics of wind in the free atmosphere. The authors show that graphs of integral functions of normal distribution do give high degree of probability that the wind velocities will not exceed or be below the limits at given conditions and can also be used for a priori judgement in individual cases of the probability for the wind to be of one or the other direction.

4. SHVED, G. M.; TSARITSINA, I. V.: ON THE FUNCTION OF INFRARED RADIATION ABSORPTION IN THE MESOSPHERE AND UPPER STRATOSPHERE.

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The article discusses the method for calculation of absorption functions and their derivatives with the purpose to determine the characteristics of radiation absorption. These characteristics are computed for individual sections of infrared spectra according to characteristics of absorption of separate complex Lorentz-Doppler contours taking into consideration variations of pressure and temperature along the optical path. This is important for detailed study of the mesosphere and upper stratosphere optical properties, particularly so for the computation of radiation heat influx in the mesosphere and upper stratosphere. This problem is closely connected with the dynamics of the upper atmosphere. Using the models of absorption bands it is possible to compute absorption characteristics for more narrow spectral intervals than those allowed by the resolving power of optical instruments used for absorption measurements.

Abstract by I.S. Groodin
June 28, 1963